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SUPPLEMENTAL NOTES ON FISHES OF THE GULF OF MAINE

By HENRY B. BIGELOW and WILLIAM C. SCHROEDER

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SUPPLEMENTAL NOTES ON FISHES OF THE GULF OF MAINE[a]

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Introduction

Since the publication by the Bureau of Fisheries of "Fishes of the Gulf of Maine" (Document No. 965, U. S. Bureau of Fisheries, Bigelow and Welsh, 1925) enough new information of general interest has come to hand regarding abundance, distribution, migrations, breeding habits, and food habits to warrant the issuance of a supplement to that publication. Many of these data have been obtained during the investigations carried on by the Bureau; part have been collected from correspondence, while part have been gleaned from published material. Brief notes

and records of distribution have been taken from the Bulletin of the Boston Society of Natural History (see Firth (1931), Kendall (1931), MacCoy (1929, 1931a, 1931b, 1933), Schroeder (1931)); from Reports of the Newfoundland Fishery Research Commission (1932–1933); and from the Proceedings and Transactions of the Nova Scotian Institute of Science (Leim 1930). For the distribution of certain New England sharks in South African waters, not referred to in this paper, the reader is referred to Barnard (1925). For allowing us the use of unpublished notes we wish to thank F. E. Firth, Dr. G. W. Jeffers, Dr. A. H. Leim, Walter H. Rich, and O. E. Sette.

The nomenclature used in this supplement is as in "Fishes of the Gulf of Maine."

Hagfish, *Myxine glutinosa* Linnaeus

Recent detailed studies of the sex organs make it certain that the hag is not functionally hermaphroditic as was formerly supposed, but that in each individual either the male portion of the common sex organ matures, with the female organ remaining rudimentary, or vice versa (Conel, 1931). The fact that a 60 cm specimen from Georges Bank contained 30 eggs, 20–25 mm long, shows that large females may produce somewhat more and slightly larger eggs than previously recorded.

Sea lamprey, *Petromyzon marinus* Linnaeus

The known range of the sea lamprey in the western Atlantic has been extended northward to the west coast of Greenland (Jensen, 1926).

Smooth dogfish, *Mustelus mustelus* (Linnaeus)

The genus Mustelus is established for this species by an opinion rendered by the International Commission on Zoological Nomenclature (Smithsonian Institution, 1926, p. 8).

Smooth dogfish are taken so seldom in winter that capture of three by a trawler off Bodie Island, N. C., in 34–45 fathoms, February 1931, is of interest.

Great blue shark, *Prionace glauca* (Linnaeus)

The International Commission on Zoological Nomenclature (Smithsonian Institution, 1925, p. 27) has rejected Valmont's name, Galeus; consequently the correct generic name of the species is Prionace Linnaeus.

The blue shark has recently been recorded from the southwest part of the Grand Bank (Rept., Nfld. Fish. Res. Lab., 1935, p. 79). Although formerly considered a stray in the Gulf of Maine, recent observations have shown the blue shark to be common there in August and September, with occasional records for July. While most often seen offshore, a number were observed and several caught by J. W. Lowes during the summer of 1935 in Massachusetts Bay.

Young ones are seldom seen along our shores, but Robert Goffin reports one only 20 inches long from Menemsha Bight, near Woods Hole, Mass., August 31, 1925; while F. E. Firth records another, 38 inches long, taken 65 miles southeast of Highland Light, Cape Cod, on October 23, 1930.

Dusky shark, *Carcharhinus obscurus* (LeSueur)

The capture of an 11-foot fish on the northeast peak of Georges Bank, August 10, 1931, extends the known range to the offshore banks (Firth, 1931, p. 9).

Shovel-head shark, *Cestracion tiburo* (Linnaeus)

One specimen of this southern species was recorded by Garman (1913, p. 160) from Massachusetts Bay.

This record was omitted from "Fishes of the Gulf of Maine" (Bigelow and Welsh, 1925).

Hammerhead shark, *Cestracion zygaena* (Linnaeus)

Captures of a 12-foot fish, in August 1928, by the swordfishing schooner *Doris M. Hawes*, between Browns and Georges Banks, and of a small one in Halifax Harbor, September 1932 (Vladykov, 1935, p. 8), extend the known range to the northward and eastward.

Thresher, *Alopias vulpinus* (Bonnaterre)

The International Commission on Zoological Nomenclature rejects Valmont's name, *Vulpecula marina*, consequently the next oldest name, *Alopias vulpinus*, must be substituted (Smithsonian Institution, 1925, p. 27).

Mackerel shark, *Isurus nasus* (Bonnaterre)

The fact that *Isurus punctatus* (Storer) is identical with *I. nasus* (Bonnaterre) has been pointed out by Bigelow and Schroeder (1927).

The range of the mackerel shark in the western side of the Atlantic is now known to extend as far north as the Grand Bank of Newfoundland (Rept., Nfld. Fish. Res. Lab., 1935, p. 79).

Sharp-nosed mackerel shark, *Isurus tigris* (Atwood)

The many recent fishery investigations in the Gulf of Maine have indicated that this species is much less common there than *I. nasus*, for whereas many of the latter have been observed and captured since 1923, only one record of the sharp-nosed mackerel shark has come to our attention within that time, a fish 8½ feet long taken 10 miles northeast of Nantucket Lightship, June 22, 1930, by the schooner *Linta* (Firth, 1931, p. 8).

White shark, *Carcharodon carcharias* (Linnaeus)

To the few existing Gulf of Maine records of this ferocious shark are added that of a 13-foot fish taken off Portland in a gill net during October 1931 (identified by Dr. W. C. Kendall); one (identified from a tooth) which attacked a fishing boat off Digby Gut, Bay of Fundy, July 2, 1932;[1] a somewhat doubtful record from off Halifax, June 27, 1930;[2] and another, 15 feet long, apparently of this species, caught off Monomoy Point, Cape Cod, in the fall of 1928.

Spiny dogfish, *Squalus acanthias* Linnaeus

The spiny dogfish is now known along the American coast as far northward as the Straits of Belle Isle. It has also been taken off the west coast of Greenland at Sukkertoppen and in the vicinity of Holsteinborg (Jensen, 1914, p. 7).

[1] Harry Piers, Proc., Nova Scotian Institute of Science, vol. XVIII, pt. 3, p. 198, 1934.
[2] Ibid., p. 196.

The winter home of the spiny dogfish off the American coast has long been a subject of uncertainty, hence it is of interest to record that the schooner *Victor* found them plentiful about 90 miles southeast of Ambrose Channel Lightship on the tilefish grounds the middle of January 1928, and that the *Albatross II* trawled many specimens in February 1931, between Cape Hatteras, N. C., and Cape Henry, Va., in 16 to 70 fathoms of water. It appears probable, therefore, that the continental slope to the southward of New England is the chief wintering ground of this species on this side of the Atlantic.

Analysis of the sizes and of the stages of development of embryos in females taken at various dates and localities along the coast, and of recent captures of new born dogfish, also adds to our knowledge (previously scanty) of the breeding habits.

Up until 1925 we had no record of new born dogfish within the Gulf of Maine. This, together with the facts that females containing large embryos had been often taken there in early autumn, that dogfish depart entirely from the gulf over the winter, and that new born young had been reported off Long Island in summer suggested that the area of reproduction of this species is confined to waters west and south from Cape Cod.

This is not the case, however, for during the past few years, when special watch has been kept for new born dogfish, we have learned of their presence in considerable numbers on Nantucket Shoals and at various localities in the Gulf of Maine from June to August. Evidently, then, the gulf, as well as the waters off southern New England, is an important nursery. The fact that embryos, sometimes with yolk sac nearly absorbed, have repeatedly been found in females off New York in autumn and on the wintering grounds off Virginia and North Carolina in January and February might suggest that the coastal waters of the Middle Atlantic States also so serve. As no new born "dogs" have yet been reported to the southward of New York at any season, this question remains open, however.

If it should prove that young are born in the southern wintering as well as in the northern summering grounds, the sizes of the embryos, at different localities and dates, would suggest that some are set free as early as January or February; in other words, that the season extends from midwinter right through the spring and summer.

Greenland shark, *Somniosus microcephalus* (Bloch and Schneider)

So seldom is the Greenland shark captured in the Gulf of Maine that it is of interest to record a large one taken off Portland Lightship the summer of 1926, and four others, 4 to 5 feet long, taken in the offing of Portland from 1927 to 1933. A large one was also taken somewhere in the gulf and brought into Gloucester in January 1929, and another, about 15 feet long, caught in an otter trawl on Jeffreys Ledge 27 miles northeast of Thatchers Island, off Cape Ann, February 16, 1931.

KEY TO SKATES AND RAYS

Experience has shown that existing keys are not adequate for the identification of Gulf of Maine skates and rays. The following revision is therefore offered:

1. No long dorsal spine on the tail 2
   Tail with long dorsal spines (sting rays) 11
2. Two small dorsal fins, but no distinct caudal fin (includes all our common skates) 3
   There is a large triangular caudal fin as well as the two dorsals ..... Torpedo
3. Ventral surface with minute rounded tubercles ..... *Raja granulata*, [3]
   Ventral surface smooth 4

[3] Although *Raja granulata* is not known from the Gulf of Maine it can be expected there as it has been recorded from La Have Bank and from the continental edge off Halifax, Nova Scotia, from 200 fathoms.

4. No thorns along mid-zone of disc between eyes and ventrals.
Barn-door skate, *Raja stabuliforis*
With one or more rows of thorns along mid-dorsal zone of disc behind eyes 5
5. Posterior third of tail without any large thorns ..... Smooth skate, *Raja senta*
Posterior third of tail with one or more rows of large thorns 6
6. Tail with only one row of large thorns ..... Young *Raja scabrata*
Tail with three or more rows of thorns 7
7. Mid-row of tail thorns very much larger than any other thorns on tail.
Prickly skate, *Raja scabrata*
Mid-row of tail thorns absent or if present not much larger than other thorns on tail 8
8. Three rows of thorns on tail ..... Brier skate, *Raja eglanteria*
Four or more rows of thorns on tail 9
9. Length of fish more than 2½ feet ..... Big skate, *Raja diaphanes*
Length of fish less than 2½ feet 10
10. Teeth in 70 to 104 rows in each jaw; usually an eye-spot present on each pectoral.
Big skate, *Raja diaphanes*
Teeth in 38 to 60 rows in each jaw; eye-spot rarely present ..... Little skate, *Raja erinacea*
11. No dorsal fins on tail ..... Sting ray, *Dasybatus marinus*
Tail with a dorsal fin in front of spine ..... Cow-nosed ray, *Rhinoptera quadriloba*

With regard to the relative abundance of different species of skates on the offshore fishing banks of the Gulf of Maine, it is of interest that on a trip to Georges Bank (chiefly the northeastern part) in September 1929, aboard the otter trawler *Kingfisher*, 37 hauls yielded from 0 to 105 skates per haul (total 495), as follows: *Raja senta*, 57; *R. scabrata*, 325; *R. stabuliforis*, 42; and *R. diaphanes*, 71.

Little skate, *Raja erinacea* Mitchill

This skate has been described as lacking thorns along the midline; but small specimens 3½ to 9½ inches long and one half-grown specimen of 13½ inches, recently examined by us, have this row well developed.

Big skate, *Raja diaphanes* Mitchill

Recent investigations have shown that the range of this skate extends northward not only to the Gulf of St. Lawrence, as long known, but to the Grand Banks as well, and southward to Virginia.

The big skate rarely has a median row of thorns except in the very young, so it is of interest to record a female 18 inches long taken near Jeffreys Ledge, November 1, 1927, which bears a row of large spines along the midline, from the shoulder girdle to the origin of dorsal on the tail.

Young specimens of *R. diaphanes* and *R. erinacea*, especially the females, are not easily separated from each other by a casual glance, hence the number of rows of teeth which they possess has been an important means of identification. Investigators have given various tooth counts ranging from 80 to 110 rows for *diaphanes* and around 50 rows for *erinacea*. Several specimens in the Museum of Comparative Zoology, from New England waters, show 70 to 100 rows of teeth on the jaw of *diaphanes* and from 46 to about 60 rows in *erinacea*.

Prickly skate, *Raja scabrata* Garman

At the time of publication of "Fishes of the Gulf of Maine" the northern boundary of this skate (widespread in the Gulf of St. Lawrence) was unknown in the open Atlantic. Since then it has been found plentifully on the Grand Banks and reported from the east and north coasts of Newfoundland.

Examination of a large number of prickly skates, ranging in size from young, recently hatched, to the largest recorded, allows us to add the following to previous descriptions:

The pavementlike teeth are in 41 or 42 rows in the upper jaw, 40 to 44 rows in lower jaw (4 specimens) and in the male, at least, there are rather sharp cusps on those teeth situated toward the angles of the jaw. The number of large curved thorns along the midline of the tail and body was as follows on 23 specimens: 12 (2), 13 (10), 14 (8), 15 (3), with no correlation between the number of thorns and the size of the specimen. The brownish back is usually marked with small white spots. The young are more spotted than the adults and have six or seven dark cross bars on the upper surface of the tail.

This skate grows to 3 feet in length, or slightly larger; a 32-inch fish is about 23 inches wide. The smallest nearly mature male found was 26 inches long.

Since nothing was known of the breeding habits of the prickly skate, it is worth recording that a specimen 32 inches long taken on the northern part of Georges Bank, September 22, 1929, had one egg capsule measuring 3 by 2¼ inches (exclusive of tendrils) in each oviduct, and that a male, 35¼ inches long had nearly ripe milt, but a number of other large females taken at the same time were barren.

Prickly skates caught on Georges Bank in September 1929, had been feeding on fish, shrimps, spider crabs, anemones, and worms; this is the first definite information as to the diet of this skate.

Brier skate, *Raja eglanteria* Bosc

An unusually large one, 37¼ inches long, was taken off Woods Hole, Mass., in August 1932.

Additional to the few Gulf of Maine records of this skate already reported are two specimens taken on Nantucket Shoals, near Round Shoal Buoy, by the *Halcyon*, one in July, the other in September 1924. This is a shoal water species, the deepest capture made by *Albatross II* between southern New England and the offing of Chesapeake Bay being in 38 fathoms.

Smooth skate, *Raja senta* Garman

The smooth skate, formerly believed rare in the Gulf of Maine, is now known to be quite generally distributed on our offshore fishing banks, as well as on soft bottom in the deeper parts of the gulf. We have taken it commonly on Georges Bank, in South Channel, in the deep water (80–100 fathoms) just off Cashes Ledge, near Jeffreys Ledge, and off Chatham. The shoalest capture was from 25 fathoms.

The largest specimen obtained was 24 inches long.

Barn-door skate, *Raja stabuliforis* Garman

Young specimens are seldom reported, hence it is of interest to record one of 7½ inches taken on the western edge of Nantucket Shoals July 14, 1930, in 28 fathoms. This fish had essentially the same characters as the adult. The range of the barn door skate is now known to extend northward to the western part of the Grand Bank of Newfoundland.

Torpedo, *Narcacion nobilianus* (Bonaparte)

As no torpedoes had been reported to the eastward of Cape Cod since 1896, the captures of a 52-inch specimen weighing 78 pounds, on the southwest part of

Georges Bank, December 8, 1930, and of another of 39 inches at Provincetown, July 28, 1931, deserve mention here.

Chimaera, *Chimaera affinis* Capello

It was formerly believed that the chimaera did not exceed a length of about 3 feet, but a specimen measuring 49 inches in length, 17½ pounds in weight dressed, was taken October 15, 1930, 85 miles south by west of Cape Sable in a depth of about 400 fathoms (Firth, 1931, p. 9).

Common sturgeon, *Acipenser sturio* Linnaeus

Although sturgeon have seldom been reported from offshore, the recent captures of a 268-pound fish in South Channel the end of April 1928, of another of 420 pounds in April 1929, of a 335-pound fish trawled on Browns Bank in April 1936, and of a 435-pound fish on Georges Bank, latitude 41°00′ N., longitude 67°45′ W., on January 7, 1931, indicate that they are to be occasionally found on our outer fishing banks.

Short-nosed sturgeon, *Acipenser brevirostris* LeSueur

A 30-inch specimen, taken at Provincetown about 1907, now in the collection of the Museum of Comparative Zoology, is the only reliable record for the Gulf of Maine. This record was omitted from "Fishes of the Gulf of Maine" (Bigelow and Welsh, 1925).

Eel, *Anguilla rostrata* (LeSueur)

The known range of the American eel in northern waters has been extended to the west coast of Greenland (Jensen, 1926, p. 101).

American conger, *Conger oceanica* (Mitchill)

The American conger, long considered identical with the European, has recently been shown by Schmidt (1931) to be a distinct species, characterized by having fewer (140–149) vertebrae than the European (154–163 vertebrae); a relationship paralleling that between the American and European eels of the genus *Anguilla*.

The American conger ranges along the continental shelf northward to Cape Cod. Its southern boundary cannot be stated until the congers of the coasts of North and South America have been critically compared.

Additional to the few records of larvae already reported from the Gulf of Maine are those of two specimens (4¼ inches long) picked up on the beach at Newburyport, Mass., in November 1929, which were sent to us for identification.

Dr. Johannes Schmidt's discovery [4] of very young larvae in the West Indian region, but nowhere else, points to this as the chief, if not the only, spawning ground of the American conger.

Snake eel, *Pisodonophis cruentifer* Goode and Bean

Goode and Bean's (1896, p. 147) record of this species from Jeffreys Bank—the only one for the gulf—was omitted from "Fishes of the Gulf of Maine." A number of specimens have been taken recently between the offings of Nantucket and of Cape Henry, Va., in depths ranging from 24 to 245 fathoms by the *Fish Hawk* and the *Albatross II*.

[4] See Schmidt, 1931, p. 602, for a discussion of this question.

Herring, *Clupea harengus* Linnaeus

The northern limit to the known range of the herring in the Western Atlantic has been extended to the west coast of Greenland by Jensen (1926, p. 101).

Herring are so seldom taken in any large numbers on the offshore banks that it is of interest to record a catch of 2,800 pounds in South Channel and 3,000 pounds on the northern edge of Georges Bank, in October 1931.

Mass destruction of young herring, cast up on the beaches has occurred from time to time in various harbors in the Gulf of Maine. A recent occurrence of this sort was reported by Dr. Austin H. Clark, who, in Manchester Harbor on the north side of Massachusetts Bay, early in August 1925, observed that the mud flats were white with stranded herring which measured 3 to 5 inches in length. Another such destruction took place in the same harbor in the summer of 1928.

Alewife, *Pomolobus pseudoharengus* (Wilson)

So little is known about the habits or migrations of the alewife while at sea that it is of interest to record the capture by *Albatross II* of 18 adults, 10 to 11 inches long, by otter trawl, seventy odd miles off Barnegat, N. J., on March 5, 1931.

Blueback, *Pomolobus aestivalis* (Mitchill)

The maximum length of this herring is usually given as about 1 foot but we have seen examples of it ranging up to 15 inches.

The capture of seven adult specimens by *Albatross II*, on March 5, 1931, about 70 miles off Barnegat, N. J., suggests that, like its relative the sea herring, the blueback moves out from land, and passes the cold season near the bottom, thus throwing some light on the probable winter home of the Gulf of Maine stock.

Thread herring, *Opisthonema oglinum* (LeSueur)

The capture of a single specimen, 7 inches long, off Monomoy Point at the southern angle of Cape Cod in August 1931, extends the known range of this southern herring to the Gulf of Maine. Occasionally the thread herring is taken off southern New England; it was even reported as rather common in Buzzards Bay and Vineyard Sound in the summer of 1885. As it is essentially a tropical fish it is not apt, however, to reach the gulf except as the rarest of strays.

Round herring, *Etrumeus sadina* (Mitchill)

This herring, recorded by Bigelow and Welsh (1925, p. 91) as *Etrumeus teres* DeKay, appears very rarely to stray past Cape Cod. Hence, it is of interest to record the capture of one specimen in Yarmouth River which empties into Casco Bay, and one in the bay itself, on September 15, 1924.

Anchovy, *Anchoviella mitchilli* (Cuvier and Valenciennes)

This species is listed by Bigelow and Welsh (1925, p. 124) as *Anchovia mitchilli.* The subgenus Anchoviella Fowler differs from the subgenus Anchovia Jordan and Evermann chiefly by having much fewer gillrakers, the former having about 35 to 50 and the latter 100 or more.

Striped anchovy, *Anchoviella epsetus* (Bonnaterre)

A record from off the Presumpscot River, near Portland, October 8, 1930 (Kendall 1931, p. 11) is the first for the Gulf of Maine. This anchovy is now known from as far northward as Halifax harbor where a number were seined September 29, 1931 (Vladykov 1935, p. 3).

Argentine, *Argentina silus* Ascanius

Until recently the argentine was considered rare in our waters, for only odd examples had been brought in from widely scattered localities. The development of otter trawling proved that argentines are in reality fairly common around the edge of Georges Bank and off Cape Cod in deep water. Thus, along the northern and northwestern slopes of the bank and to the eastward of Cape Cod, in depths of 80 to 100 fathoms, it is not unusual for a haul of the trawl to bring in from one to a dozen, and as much as 15,000 pounds has been reported by one boat during a week's fishing (Firth 1931, p. 11). It also occurs in the deep central basin of the gulf, for the *Albatross II* has recently (July 1931) trawled a specimen in 115 fathoms off Mount Desert Rock.

Pearlsides, *Maurolicus pennanti* (Walbaum)

Additional Gulf of Maine records of this species include one specimen 41 mm long taken from the stomach of a cod, on Platts Bank, July 27, 1924; one 43 mm long, also from a cod's stomach, on Cashes Ledge, August 16, 1928; and four, 32 to 39 mm long, from the stomachs of two pollock, caught in 20 fathoms, 7 miles southeast of Bakers Island, Mount Desert, Maine, July 24, 1930.

Viperfish, *Chauliodus sloanei* Bloch and Schneider

A specimen found in the stomach of a swordfish caught in the gully between Browns and Georges Banks in 1931 is the second to be definitely recorded from within the Gulf of Maine.

Lancetfish, *Alepisaurus ferox* Lowe

A record of a 5½-foot specimen of this rare fish caught alive in the surf on Block Island, R. I., March 12, 1928, is of especial interest even though outside the limits of the Gulf of Maine. An excellent photograph, sent in by Mrs. Elizabeth Dickens, shows the upper lobe of the caudal prolonged as a long filament, which most of the specimens so far seen have lost. This specimen had been feeding on small dogfish.

Needlefish, *Scomberesox saurus* (Walbaum)

A specimen gaffed at the surface from the *Albatross II* on northern Georges Bank, September 20, 1928, is the only definite offshore record for the Gulf of Maine although the needlefish has been taken in various localities there alongshore.

Trumpetfish, *Fistularia tabacaria* Linnaeus

Recent reports of the trumpetfish at Port Mouton, Nova Scotia, and on the south coast of Newfoundland, show that this tropical species may stray much farther north than previously supposed.

Pelagic pipefish, *Syngnathus pelagicus* Linnaeus

A single specimen 3½ inches long, taken on Georges Bank (lat. 42°09′ N., long. 66°41′ W.) September 20, 1927, by the *Albatross II*, is the only Gulf of Maine record. This specimen was dipped up with a mass of gulf weed (Sargassum) and was the only one found in a large amount of weed that was examined.

Common pipefish, *Syngnathus fuscus* Storer

Pipefish are rarely taken on bottom far from the immediate shore waters, hence it is of interest to report the capture of four specimens 4½ to 6 inches long at a depth of 19 fathoms 10 miles south of No Mans Land, February 5, 1930.

Northern barracuda, *Sphyraena borealis* DeKay

A specimen about 2 inches long found alive in the surf at Nauset Beach, Cape Cod, September 26, 1930, by Dr. Edward P. Richardson, is the only record thus far reported for the Gulf of Maine. Young fry, a few inches long, are taken, however, from time to time in the region of Vineyard Sound and Buzzards Bay on the southern coast of New England, from July to December.

Mackerel, *Scomber scombrus* Linnaeus

The body length of the mackerel is erroneously given as about three and one-half times the depth by Bigelow and Welsh (1925, p. 188); actually, it is four to five and one-half times the depth.

A small mackerel taken at Cape Lookout, N. C., in February 1925 (Coles, 1926, p. 105), extends the known range southward beyond Cape Hatteras.

Recent captures of a mackerel weighing 7½ pounds,[5] and of another of 7¼ pounds, 26 inches long, both of which we, ourselves, examined, shows that occasional giants occur, for the weight seldom exceeds 4 pounds or the length 22 inches.

Tuna, *Thunnus thynnus* (Linnaeus)

Larger catches of tuna have been made within the Gulf of Maine in recent years partly, at least, because of an increased market demand for the fish. Thus, compared with the 69,868 pounds recorded for Massachusetts and Maine in 1919, the catch of 1934 amounted to 356,904 pounds, of which 254,076 pounds came from Cape Cod. The Nova Scotian shore of the Gulf of Maine yielded about 24,000 pounds in 1924 and 10,000 pounds in 1929. At present the annual catch for the gulf is probably between 300,000 and 400,000 pounds. Assuming an average weight of 300 pounds (probably too little, for the average weight of about 90 tuna caught off the coast of Maine in 1926 was about 540 pounds), this would represent a thousand or more fish. Off the outer coast of Nova Scotia, where tuna have been taken in larger numbers than within the Gulf of Maine, the annual catches from 1917 to 1933 have fluctuated between 152,000 and 1,550,000 pounds.

The heaviest New England fish on record, taken off Rhode Island about 1913, weighed 1,225 pounds, while four or five fish have been brought into Boston that weighed approximately 1,200 pounds. Another fish weighing 1,300 pounds was shipped in 1924 from Nova Scotia to Boston (Sella, 1931, p. 61).

[5] Atlantic Fisherman, August 1925.

Small and moderate sized tuna (below 100 pounds) are comparatively rare in the Gulf of Maine. However, schools composed of individuals estimated to weigh not more than 40 to 70 pounds were observed around Boston lightship July 13 and 14, 1935.[6] None below 20 pounds has been recorded within the gulf, but off southern New England, especially near Block Island, small tuna are sometimes caught, there being an unusual run of them (8 to 12 pounds) in 1928. Thus it is probable either that the lower temperatures of the Gulf of Maine are a barrier to the smaller-sized tuna, or that they find less favorable feeding grounds there than do the larger sizes.

Off the New England coast the first schools are sighted late in June or early July to the southward of Block Island, over depths of about 85 fathoms, and a few days later they appear inshore. At first the fish are hungry, and there is some reason to believe that their summer migrations follow their breeding period. An example of their seasonal abundance in the shore waters of the coast of Maine may be had from the catches made in the vicinity of Casco Bay in 1926, where about 70 fish were taken in July, 17 in August, 3 in September, and 1 on October 4.

Common bonito, *Sarda sarda* (Bloch)

Two fish were reported from the mouth of Kennebec River in July and one in September 1930, and one from southern Nova Scotia (Vladykov, 1935, p. 7) in the latter month.

In looking through the records of the catches made by a certain set of pound nets at Provincetown over a period of 10 years, we find the earliest catch for that locality was in July (1915), and the latest on October 4 (1919).

Spearfish, marlin, *Makaira albida* (Poey) [7]

No spearfish were reported in the Gulf of Maine from about 1880 until 1925. Since then, however, seven specimens have been brought in, all in summer, one of them from off Portland, the others from Georges, Browns, and Sable Island Banks, the last being the most northerly record for the species in the western North Atlantic. These specimens ranged from 5 feet to nearly 16 feet in length and from 21 to about 700 pounds in weight.

Additional descriptive data based on two New England specimens examined by us are as follows: The first dorsal fin of one specimen has 47 stiff rays, the other fish having 48. This fin is separated from the second dorsal by a space equal to the length of the latter in the one fish, by a shorter space in the other. The first anal fin (2 spines and about 12 or 13 rays), situated below the rear part of the first dorsal, is triangular, its first rays forming a sharp angle.

Swordfish, *Xiphias gladius* Linnaeus

The largest swordfish definitely recorded from the Gulf of Maine was one, caught in the summer of 1921 by Capt. Irving King and landed at the Boston Fish Pier, that weighed 915 pounds dressed—hence, upward of 1,000 pounds alive (Fishing Gazette, September 1921, p. 13). The specimen was not measured, but the sword being more than 5 feet, the total length of the fish must have approximated 15 feet.

[6] Data furnished by J. W. Lowes.

[7] Recorded by Bigelow and Welsh (1925, p. 227) as *Tetrapturus imperator* (Bloch and Schneider).

In 1931, another large fish was caught, 644 pounds in weight, dressed, 13 feet in length, with a sword measuring 3 feet 8 inches.

Young swordfish are so rarely reported off the New England coast that it is of interest to record the capture of a 2-foot fish, weighing 7¾ pounds, taken by the *Dacia* on a trawl line September 2, 1931, on Georges Bank.

Pilotfish, *Naucrates ductor* (Linnaeus)

Up to 1925 only three definite records for the Gulf of Maine had come to hand. Since then we have learned of the capture of six more pilotfish, off Portland, in Provincetown Harbor, to the southeast of Cape Cod, and on the northern edge of Georges Bank, during the summer and fall months in the years 1921, 1924, 1929, 1931, and 1933. Vladykov (1935, p. 6) reports two specimens from Sable Island Bank and one from Sambro, off Nova Scotia, in the period 1932–34.

Rudderfish, *Seriola zonata* (Mitchill)

The known range of the rudderfish has been extended northward to Halifax, Nova Scotia (Leim, 1930, p. xlvi, as *S. dumerili*).

One fish was caught on a smelt hook off a Portland wharf in September 1921; a 5½-inch fish was taken off Boston in September 1929; another, 17½ inches long, from South Channel the same month; and a 6-inch specimen on Nantucket Shoals in August 1930.

Mackerel scad, *Decapterus macarellus* (Cuvier and Valenciennes)

One specimen, 7 inches long, was taken in a trap at Richmond Island, off Cape Elizabeth, in September 1931, this being only the second recorded for the Gulf of Maine.

Saurel, *Trachurus trachurus* (Linnaeus)

One specimen of this fish, rare to the northward of Woods Hole, Mass., was taken in Casco Bay on August 12 and another near Castine Bay, Maine, on October 15, 1930 (Kendall, 1931, p. 11).

Big-eyed scad, *Trachurops crumenopthalma* (Bloch)

Two specimens, recently taken off Cape Cod, one at Provincetown, the other about 8 miles off the beach at Chatham, are the only positive records of this species for the Gulf of Maine. As it is caught from time to time, however, in the summer and fall as far northward as Woods Hole, it may be expected to round the cape occasionally. This scad has been recorded from Canso, Nova Scotia by Cornish (1907, p. 85).

Hardtail, *Caranx hippos* (Linnaeus)

A hardtail taken off Provincetown in 1933 is the second reported from the Gulf of Maine. Several specimens about 2 inches long were taken the summer of 1933 in Musquodoboit Harbor, Nova Scotia (Vladykov, 1935, p. 4).

Hardtail, *Caranx crysos* (Mitchill)

One fish was taken off Chatham in 1933.

Lookdown, *Selene vomer* (Linnaeus)

During the autumn of 1933 many small lookdowns were reported from traps at the mouth of Casco Bay, one also from Beverly Farms, and another from North Truro, an unusual incursion, for only three specimens had previously been recorded in the Gulf of Maine. Jones (1882 p. 89) and Honeyman (1886 p. 328) record this species (young) as occasional in the shore waters of Nova Scotia, presumably along the east coast.

Leatherjacket, *Oligoplites saurus* (Bloch and Schneider)

A specimen taken in a trap off the outer beach at Chatham is the only record for the Gulf of Maine.

Bluefish, *Pomatomus saltatrix* (Linnaeus)

For many years no bluefish had been reported north of Cape Ann, until 1925, when one was caught off Halifax, Nova Scotia. This seems to have presaged a temporary extension of range, for numbers of them visited the inner coasts of the gulf northward to Casco Bay in the summer of 1927, while in 1930 the bluefish was again reported at Halifax (two specimens) and at Port Mouton, Nova Scotia (one specimen, Leim, 1930, p. xlvi).

Common dolphin, *Coryphaena hippurus* Linnaeus

A dolphin about 3½ feet long taken 60 miles south-southwest of Cape Sable, in the deep gully between Browns and Georges Banks by the trawler *Natalie Hammond*, August 15, 1930, is the first Gulf of Maine record. The specimen is now in the collection of the Boston Society of Natural History.

Opah, *Lampris regius* (Bonnaterre) [8]

A specimen about 3 feet long was taken in July 1925, on Western Bank, southwest of Sable Island, by the schooner *Falmouth* (Radcliffe, 1926), while another of about the same size stranded on the beach at Hyannis, Mass., on September 17, 1928.

Johnson's sea bream, *Taractes princeps* Johnson

A fish taken on Browns Bank, off Cape Sable in January 1928 is the first record of this species for the western Atlantic. This bream previously was known only from Madeira, in the eastern Atlantic. For a detailed account and comparison with allied species see Bigelow and Schroeder (1929).

Butterfish, *Poronotus triacanthus* (Peck)

Recent records show that the northward range of this species extends to the east coast of Newfoundland, as well as to Nova Scotia as has long been known.

It now seems well established that the butterfish actually withdraw from the gulf when they disappear in the autumn, as they do from the immediate shore waters farther south, and from inland waters such as Chesapeake Bay. Until very recently the winter home of the butterfish was unknown; but as they are now often taken in the winter otter trawl fishery recently established off the coast between Chesapeake

[8] This species was given as *Lampris luna* (Gmelin) by Bigelow and Welsh (1925, p. 242).

Bay and Cape Hatteras, it appears that they move out to sea to winter on the outer part of the continental shelf as do several other common Gulf of Maine fishes.

The illustrations of larvae 2.1 and 3.4 mm long credited by Kuntz and Radcliffe (1918) to the butterfish and reproduced by Bigelow and Welsh (1925, fig. 116, *c* and *d*) have since been proved to belong to one of the hakes.

Harvestfish, *Peprilus alepidotus* (Linnaeus)

Five or six specimens were reported caught in floating traps at Richmond Island, off Cape Elizabeth, Maine, in July 1929, while another was taken at the mouth of the Damariscotta River, Maine, in August 1933, the most northerly record for the species.

Striped bass, *Roccus lineatus* (Bloch)

The striped bass considerably increased in abundance along both shores of Cape Cod between 1928 and 1932, then decreased again as illustrated by the following catches reported for Barnstable County, Mass.: 1928, 8,060 pounds; 1929, 18,665 pounds; 1930, 27,385 pounds; 1931, 33,600 pounds; 1932, 30,926 pounds; 1933, 4,500 pounds. Anglers as well as commercial fishermen have also caught some numbers along the Eastham-Chatham Beaches and marshes during the past few years, while a 44¾ pound bass was caught near Brant Rock on the southern shore of Massachusetts Bay, in November 1930. A small stock seems also to have built up in the brackish tributaries of Plum Island Sound north of Cape Ann, for some were taken in Parker River by anglers during the few years previous to 1930, while in that year (when fishing restrictions were relaxed) 8,700 pounds were reported thence, though smaller numbers since then. But this increase did not extend northward beyond Massachusetts waters, for the commercial reports from the States of New Hampshire and Maine did not mention bass at all in 1924, or in 1928–33.[9]

Striped bass so rarely stray away from the immediate shoreline that it is of interest to mention the capture of a 6-pound fish in a gill net on Cod Ledge, 3 or 4 miles off Cape Elizabeth, Maine, October 15, 1931.

Sea bass, *Centropristes striatus* (Linnaeus)

Sea bass are seldom taken within the Gulf of Maine, and even on the southern New England coast are rarely caught later than early November, hence the reported capture of a 5-pound fish in December 1930, 5 miles east of Pollock Rip Lightship, in 24 fathoms, is noteworthy.

Triggerfish, *Balistes carolinensis* Gmelin

Previous to 1925, only one specimen of the trigger fish had been reported from the Gulf of Maine. Actually, this species must drift over the offshore rim of the gulf more often than the paucity of early records would suggest, for a specimen was recorded from Casco Bay in August 1931; another was taken in 1932 near Plymouth; a third, 15 inches long, was gaffed at the surface, on the southeast part of Georges Bank, from the fishing vessel *Huntington Sanford*, in July 1929; and two small fry, 2 to 3 inches in length, were picked up on the northeast part of the bank in mid-September 1927, by the *Albatross II*. The fact that these last were taken with gulf weed (Sargassum) suggests that triggerfish are most apt to appear on the banks with the latter.

[9] No statistics are available for 1925–27.

Filefish, *Monacanthus hispidus* (Linnaeus)

The filefish appears in the inner parts of the gulf only as a stray from warmer seas, recent records being that of a fish taken off Seguin, September 12, 1929, one off Portland lightship, July 17, 1931, and a 6-inch fish at Provincetown, November 6, 1929. On the offshore banks, however, it is to be expected more frequently (which accords with its southern origin) for the *Albatross II* gathered 181 small fry 1 to 2 inches long, on the northeastern part of Georges Bank among floating gulf weed (Sargassum) in September 1927; while a larger one was picked up to the southeast of Cape Cod in that same month of 1930.

Filefish, *Monacanthus ciliatus* (Mitchill)

A 7-inch fish taken in a Provincetown trap in November 1929 is the second (and only recent) record of this species within the Gulf of Maine (Firth, 1931, p. 13). A straggler has been reported, however, from Newfoundland—far to the north of its previously known range.

Unicornfish, *Alutera scripta* (Osbeck)

Two specimens of this fish, 5 and 5½ inches long, respectively, caught on the western edge of Georges Bank, constitute the first Gulf of Maine record (Mac Coy, 1931a, p. 16).

Puffer, *Spheroides maculatus* (Bloch and Schneider)

A specimen taken off Long Island, Portland Harbor, on July 24, 1933, is the first to be recorded from the northern boundary (Casco Bay) of this species since 1896.

Rosefish, *Sebastes marinus* (Linnaeus)

It is now known that rosefish may be born in the Gulf of Maine as early as the end of April, for in 1930 we saw gravid females during the last half of that month. In July 1931 the *Albatross II* trawled many gravid females, 10 to 13½ inches long, in the central basin of the gulf; one of these, 13 inches long, contained approximately 20,500 young 6 to 7 mm long, ready to be spawned.

The fact that we obtained many young fish 2½ to 5¾ inches in length, off the coast of Maine from April to August, suggests that this is the approximate size attained during their first year of life.

Recent catches of 75–625 rosefish per haul in a trawl by the *Atlantis* in 70–130 fathoms in the western and northeastern parts of the gulf are evidence of the abundance of this species over the soft bottoms of the basins, as well as in other parts of the gulf. The commercial importance of this species has greatly increased of late, the reported landings having risen from 1,288,000 pounds in 1934 to 14,100,000 pounds in 1935.

Black-bellied rosefish, *Helicolenus dactylopterus* (De la Roche)

A fish 13 inches long, trawled on the eastern edge of Georges Bank in 150 fathoms, October 6, 1929 (Firth, 1931, p. 13), is the first record for this species within the Gulf of Maine. In addition to previous records from outside the gulf, a number of small fish (1¼ to 3½ inches) were trawled off southern New England in 80 to 118 fathoms during 1930.

Hook-eared sculpin, *Artediellus uncinatus* (Reinhardt) [10]

This sculpin is now known to be generally distributed in the Gulf of Maine in depths greater than 20 to 30 fathoms. Thus, in addition to the Massachusetts Bay records of many years ago, we have recently taken it repeatedly near Mount Desert, off Cape Elizabeth, near Jeffrey's Ledge, around Cashes Ledge, along the northern slopes of Georges Bank, in the southeastern part of the basin of the gulf, and at the entrance to the deep gully between Georges and Browns Banks, in depths ranging from 20 to 150 fathoms. Individual hauls have yielded up to six or eight specimens, both on hard and on soft bottom.

After examining specimens from New England waters and comparing published drawings of European fish, we can find no major differences between the hook-eared sculpins of the eastern and western Atlantic.[11]

Mailed sculpin, *Triglops ommatistius* Gilbert

This sculpin is not as rare in the Gulf of Maine as was formerly supposed, for during the past few years we have trawled specimens near Mount Desert, in Massachusetts Bay, off Cape Ann, off Cape Cod, and around the northern slope of Georges Bank, in depths of 20 to 140 fathoms, in various months from spring to autumn. The most southerly locality was about 10 miles east of Chatham.

Longhorn sculpin, *Myoxocephalus octodecimspinosus* (Mitchill)

Numerous young specimens 1½ to 2 inches long taken in September, and 3 to 3½ inches in February, suggest that the longhorn sculpin is about 2 to 3 inches long at 1 year of age, spawning as it does in late fall.

Deep-sea sculpin, *Cottunculus microps* Collett

A specimen, about 2 inches long, trawled by the *Albatross II* on the northern slope of Georges Bank, in a depth of 120 fathoms, on July 24, 1931, is the third record for the Gulf of Maine proper.

Sea raven, *Hemitripterus americanus* (Gmelin)

The fact that fish of both sexes with gonads only partially developed have recently been found on Nantucket Shoals late in June, added to previous captures of ripe females off southern New England in November and December shows this to be a late fall and early winter spawner. The sea raven is a prolific fish, for a female 20 inches long that we caught off Boothbay Harbor, Maine, in April 1925, contained about 10,000 eggs. The fact that these were definitely of two sizes, the smaller averaging 1.5 mm in diameter, the larger about 3 mm, raises the interesting question whether individual sea ravens may spawn more than once during the year.

The sizes of the few young sea ravens that have been taken in the Gulf of Maine suggest that they reach a length of 2 to 4 inches by the middle of the first summer, when 6 to 8 months old; and about 6 inches by the following April, at an age of 1½ years.

[10] Given as *Artediellus atlanticus* Jordan and Evermann by Bigelow and Welsh (1925, p. 314).

[11] Jordan, Evermann, and Clark (1930, p. 377) in the Check List of Fishes placed *Artediellus atlanticus* Jordan and Evermann in the synonymy of *A. uncinatus* Reinhardt.

Sea snail, *Neoliparis atlanticus* Jordan and Evermann

The sea snail, previously unknown offshore, has recently been taken on Georges and on Browns Banks. Its range has recently been found to extend as far southward as the offing of Atlantic City, N. J. (Lat. 39°20′N.). Most of the specimens were found living in scallop shells (*Pecten magellanicus*), as is so often the case.

Striped sea snail, *Liparis liparis* (Linnaeus)

This sea snail was formerly known as far southward as New York but the *Albatross II* has taken it off Delaware Bay and the *Grampus* off Assateague, Va. (Welsh, 1915, p. 2).

Red-winged sea robin, *Prionotus strigatus* (Cuvier)

A specimen was taken off Monhegan, Maine, in 40 fathoms, in an otter trawl November 19, 1933. This is the most northerly record for this straggler in the Gulf of Maine.

Remora, *Remora remora* (Linnaeus)

Recent Gulf of Maine records of this species include one found on the bottom of a lobster trap in Portland Harbor in 1931, probably brought in by a schooner from the West Indies; one found sucking to the gills of a blue shark (*Prionace glauca*) that was caught on the northeast edge of Georges Bank, August 1, 1931; one in Cape Cod Bay in September 1934, and one off Provincetown in August 1935, taken by C. W. Lowes on blue sharks; also two specimens, 6 and 17 inches long, respectively, taken on August 3, 1932, 220 miles east-southeast of Cape Ann. Previously it had been recorded only once from the Gulf of Maine.

Rock eel, *Pholis gunnellus* (Linnaeus)

Recent records show that the rock eel occurs in considerable numbers on the offshore banks in the Gulf of Maine down to at least 40 fathoms and occasionally even to 100 fathoms (Schroeder, 1933, p. 5) as well as inshore. So many have been found in the stomachs of cod and pollock caught on Nantucket Shoals, Georges Bank, Browns Bank, Cashes Ledge, etc., that it must be an important food of these two species.

The range of the rock eel recently has been found to extend south to the latitude of Delaware Bay, where in February 1930 *Albatross II* trawled two specimens in 23 and 38 fathoms, respectively.

Snake blenny, *Lumpenus lampetraeformis* (Walbaum)

Recent captures, by *Albatross II*, of adult snake blennies (one specimen each) off Mount Desert, off Boone Island, and on Stellwagen Bank, in depths ranging from 28 to 88 fathoms, added to earlier records from Massachusetts Bay and from the Bay of Fundy region, show that this species is generally distributed over the gulf, as records of its larvae had suggested. So slender and active is this fish that it can easily escape through the meshes of any of the nets used by commercial fishermen, hence it is seldom reported.

Color notes taken from a 12-inch specimen are as follows: The body had brown markings on a whitish ground, the head being pale brown. The dorsal fin was marked obliquely with 18 pale bars, the caudal transversely with 8. The anal rays were pale brown against a colorless membrane, the ventrals white, while the pectorals were tinged with brown.

One of 19 inches caught on the eastern slope of Stellwagen Bank in 42 fathoms in July 1931 is the largest on record.

Shanny, *Leptoclinus maculatus* (Fries)

One specimen of this stray from the north was trawled on the northeast part of Georges Bank in August 1926 and four (4 to 4½ inches long) were taken off Chatham, Cape Cod, in 28 fathoms, May 1, 1930, by the *Albatross II*. This is the most southerly record for the species.

Arctic shanny, *Stichaeus punctatus* (Fabricius)

A specimen 4½ inches long of this arctic species, taken one-half mile off Little Duck Island near Mount Desert, Maine, from the stomach of a cod, on April 30, 1930, is the first record for the Gulf of Maine; the only record indeed to the southward of Newfoundland. This specimen was in such good condition that it unquestionably had been living in the immediate vicinity.

Radiated shanny, *Ulvaria subbifurcata* (Storer)

This shanny was previously known to be rather common in the northeastern part of the gulf, and enough have now been found in the stomachs of cod caught on Cashes Ledge, Georges Bank, Nantucket Shoals, and other offshore grounds to show that it is widespread in other parts of the gulf as well, on hard bottom. The deepest capture was in 45 fathoms.

Wrymouth, *Cryptacanthodes maculatus* Storer

Recent captures of two specimens in the central basin of the Gulf of Maine, July 1931, in 88–95 fathoms, of three in August 1936, in 72–100 fathoms, and of another on the continental slope between 245 and 325 fathoms, shows that this species is not as closely restricted to the vicinity of the coast as previously supposed and that it reaches considerably greater depths.

The locality of the capture (taken by *Atlantis*) last mentioned (lat. 39°31′ N; long. 72°16′ W.) also extends the known range somewhat farther south.

Spotted wolffish, *Anarrhichas minor* Olafsen

This Arctic species is seldom taken within the Gulf of Maine, hence the capture of a small specimen, weighing 3¼ pounds, on a trawl, off Portand Lightship on April 23, 1927, is worthy of mention. On the Scotian banks, however, it is not so uncommon, for we have records of 2, 37 and 54 inches long, respectively, caught on Sable Island Bank in January 1934 and 5 more in March of that year. Usually about 5 to 10 from this general region are landed each year at the Boston Fish Pier.

Eelpout, *Zoarces anguillaris* (Peck)

Many small specimens from 1.8 inches long upward, have recently been collected along our coast between Maine and New Jersey, including (within the gulf) Mount Desert, Stellwagen Bank, Georges Bank, and the vicinity of Chatham, suggesting that the eelpout breeds successfully throughout this range. And as all the young thus far taken have been caught in depths of 20 to 45 fathoms, probably this is the usual spawning zone. Although eelpouts have seldom been reported deeper than 50

fathoms, *Albatross II* recently (July 1931) trawled a number in the basin of the gulf as deep as 90 fathoms.

The sizes, in different months, of the young fry show that eelpouts in the Gulf of Maine grow to a length of about 2 inches in the first 6 months of their lives, and 3 inches in 9 months, agreeing in this respect with the growth-schedule of Bay of Fundy eelpouts derived by Clemens and Clemens (1921, p. 74) from the annual rings on the otoliths. Small specimens 5 to 6½ inches long taken from February to May are probably about 1½ years old.

Young eelpouts, up to 3 or 4 inches long, are checkered along the sides, and irregularly blotched on the back with light and dark brown, with a small but prominent black spot, which fades out with growth, on the anterior part of the dorsal fin.

Wolf eel, *Lycenchelys verrillii* (Goode and Bean)

The recorded range of the wolf eel, previously known only off the coasts of New England and Nova Scotia, has now been extended southward to the offing of New York (Beebe, 1929, p. 18).

The wolf eel is more common within the Gulf of Maine, in deep water, than was formerly supposed, for in the autumn and summer of 1928 and 1930 the *Albatross II* trawled 61 specimens, 6 to 6½ inches long, in the deep basin to the westward of Jeffreys Ledge, in about 90 fathoms of water. It was also found scattered over the central basin of the gulf, in July 1931, in 95 to 123 fathoms.

Silver hake, *Merluccius bilinearis* (Mitchill)

The wintering ground of the Gulf of Maine stock of silver hake has been the subject of so much speculation that the capture by the *Albatross II*, of many specimens between the offings of No Mans Land and off Cape Hatteras in depths ranging from 12 to 146 fathoms, in February 1930 at temperatures of 4.2° to 10.6° C. (39.5° to 51° F.), deserves mention. Such wide ranges of temperature indicate that the silver hake are well distributed on these offshore grounds during the winter.

Young fish are rarely found close to shore within the gulf. Offshore, however, the *Albatross II* and *Atlantis* have trawled large numbers between 2 and about 8 inches long in widely scattered localities and in depths ranging from 20 to 115 fathoms.

Measurements of young silver hake,[12] recently obtained in the Gulf of Maine indicate that a length of 6–7 inches is attained at about 1 year of age.

Pollock, *Pollachius virens* (Linnaeus)

Recent tagging experiments verify the earlier view that the pollock which appear in the cold months of the year off New York and New Jersey are winter migrants from the region of Nantucket Shoals. In general the pollock in the Gulf of Maine are not migratory although occasional fish may make long journeys.

Cod, *Gadus callarias* Linnaeus

Extensive tagging experiments (Schroeder, 1930) have proved that the appearance of cod in winter southward along the coasts of New York and New Jersey in commercial quantities represents a regular annual mass migration from Nantucket Shoals followed by a return migration in spring. But only scattering fish join this

[12] Several hundred specimens.

winter migration from the more northerly and easterly parts of the Gulf of Maine. It has been known that many of these cod spawn on the southern wintering grounds, but it was not until the spring of 1930 that large numbers of fry were obtained there. At that time (April) *Albatross II* trawled hundreds of fry 1½ to 2½ inches long on bottom, the most southerly catch being in latitude 36°21′ N.[13]

Haddock, *Melanogrammus aeglefinus* (Linnaeus)

The haddock, formerly unknown beyond the Straits of Belle Isle, in the western Atlantic, has now been reported from West Greenland (Jensen and Hansen, 1930, p. 52). From Icelandic waters comes a record of a giant haddock 44 inches long and weighing about 37 pounds (Thompson, 1929, p. 29).

Long-finned hake, *Urophycis chesteri* (Goode and Bean)

The capture of several specimens on the northern edge of Georges Bank in September 1929, in 85 to 100 fathoms, and of many to the westward and in the central basin of the Gulf of Maine the summer of 1931, in 70 to 140 fathoms, suggests that this species is more plentiful in the gulf than was previously supposed.

This hake is said to be a summer spawner but very little is known concerning its rate of growth, hence we report captures of 3 fish 57 to 71 mm on April 26, 1931, and of 16 fish of 74 to 110 mm taken late in July, suggesting that a length of 4 or 5 inches is reached at 1 year of age.

Spotted hake, *Urophycis regius* (Walbaum)

The scarcity of this hake within the Gulf of Maine is emphasized by the fact that not a single one was captured there in the numerous hauls made recently by the *Albatross II*. To the southward, however, many were trawled between Cape Hatteras and the offing of Delaware Bay in 5 to 45 fathoms (chiefly in less than 20 fathoms) from February to May 1930 and 1931.

Although the spotted hake reaches a length of at least 16 inches, large fish are relatively rare. The longest of about 600 specimens taken on 14 stations by the *Albatross II* was only 130 mm (5⅛ inches). In the largest catch (Apr. 8) the dominant size was 2 to 2½ inches.

Four-bearded rockling, *Enchelyopus cimbrius* (Linnaeus)

The rockling has recently (July 1931) been trawled in the central basin of the Gulf of Maine where it was expected, but heretofore unrecorded. The fact that one was taken in latitude 36°56′ N., off Cape Charles, Va., on February 10, 1930, in only 12 fathoms, shows that in the most southerly parts of its range, it is not restricted to deep water, as previously supposed.

Cusk, *Brosme brosme* (Müller)

A fish 40 inches long and weighing 27 pounds, trawled by *Albatross II* in the central part of the Gulf of Maine, in 120 fathoms, is the largest definitely recorded from the Gulf of Maine.

[13] These were taken during the course of O. E. Sette's mackerel investigations.

Common grenadier, *Macrourus bairdii* Goode and Bean

Recent records show that the grenadier is comparatively common on muddy bottom in the gulf, at depths greater than about 90 fathoms and that it may occasionally be taken shoaler, for one was reported from the slope of Jeffreys Ledge in about 50 fathoms during March 1934. The capture of a ripe male in late September verifies the earlier suggestion that the grenadier is an autumn spawner. The largest fish taken by *Albatross II* was 16 inches long. This grenadier has now been taken as far eastward as the Grand Banks of Newfoundland (Nfld. Rpt., 1933 (1934), p. 116).

American plaice, *Hippoglossoides platessoides* (Fabricius)

Recent trawling by *Albatross II* and *Atlantis* proves this species to be generally distributed even in the deeper parts of the central basin of the gulf, to a depth of at least 120 fathoms. A specimen 15½ inches long caught off Montauk Point, N. Y., in 112 fathoms, February 6, 1930, is the most southerly and westerly record.

As this flounder is a spring spawner it may be assumed that bottom stages 69 to 80 mm long trawled off Cape Cod, May 1, were about 1 year old, and 85 to 118 mm fry found at several localities in July and August were between 1¼ and 1½ years old, those of 8–10 inches, 2¼ to 2½ years.

Four-spotted flounder, *Paralichthys oblongus* (Mitchill)

This flounder, formerly thought rare to the east of Cape Cod, has recently been found here and there on the southern half of Georges Bank. Previously known only as far southward as New York, many have been trawled by the *Albatross II* south to the Virginia Capes (lat. 36°45′ N.).

The fact that captures were made in 23 to 112 fathoms in February (7 stations), 31 to 52 fathoms in March (two stations), 10 to 85 fathoms in April (eight stations), 15 to 35 fathoms in May (four stations), 11 to 47 fathoms in June (five stations), and 41 fathoms in July (one station) indicates that it is present and widely distributed in this general depth zone the year round.

The capture of ripe specimens as late as mid-July shows that the breeding season is not limited to spring, as formerly supposed, but extends well into the summer.

Rusty dab, *Limanda ferruginea* (Storer)

Capture of a specimen, in the offing of Hog Island, Va. (lat. 37° 41′ N.) considerably extends the known range to the southward. The captures of young dabs 2 to 4 inches long in February (17 fish), 2¼ to 4½ inches in April (26 fish), 2⅓ to 5⅝ inches in May (10 fish), 3 to 5 inches in June (3 fish) and 3 to 6⅓ inches in July (13 fish) yield the first data as to rate of growth. According to this growth schedule the rusty dab reaches a length of approximately 5 inches at 1 year of age.

Winter flounder, *Pseudopleuronectes americanus* (Walbaum)

The recovery, off Chatham and on Nantucket Shoals, of winter flounders tagged and released at Woods Hole proves that some of them, at least, may wander for longer distances than previously supposed.

Georges Bank flounder, *Pseudopleuronectes dignabilis* Kendall

This flounder, previously known only from the Georges Bank area, is now reported from the eastern edge of the Scotian banks and the western part of the Grand Banks of Newfoundland (Nfld. Rept., 1934 (1935), p. 79).

Witch flounder, *Glyptocephalus cynoglossus* (Linnaeus)

The witch flounder has recently been found to be generally distributed in the central basin of the Gulf of Maine where the *Albatross II* and *Atlantis* trawled it down to 140 fathoms, in July 1931 and in August 1936, respectively. Goode and Bean's (1896, p. 433) record of it in latitude 34°39′ at a depth of 603 fathoms (omitted in Bigelow and Welsh, 1925) shows that it ranges southward to the offing of Cape Hatteras in deep water. But the most southerly record of it in shoal water is a specimen taken by *Albatross II* in 10 fathoms off Virginia (lat. 37°50′).

Many specimens from 3 to 5 inches and from 7 to 8½ inches long were taken from July to September suggesting that the witch reaches a length of about 4 inches at 1 year and about 8 inches at 2 years of age.

Gulf Stream flounder, *Citharichthys arctifrons* [14] Goode

This little flounder was formerly believed to reach a length of only about 4 inches but recently the *Albatross II* collected many specimens up to 7 inches long.

Recent trawling experience extends knowledge of its distribution by showing that it may occur as shoal as 12 fathoms, and that it finds its northeastern boundary off the southeastern slope of Georges Bank and its southwestern boundary off Cape Hatteras. Usually only a few specimens are taken in any given trawl haul, even further to the west and south where the species appears to be most common; hence, a catch of about 100 made by the *Albatross II*, off Montauk Point, N. Y., in 50 fathoms, is noteworthy.

Apparently, it spawns over a long season, from spring through summer, for we have found females with well-developed ovaries in February while Goode had ripe ones in September. Although the Gulf Stream flounder is not large enough and thus far has been found too scarce to be of commercial value, we can witness that it is excellent on the table.

American goosefish, *Lophius americanus* Cuvier and Valenciennes

Recent investigations by Berrill (1929) and by Procter et al. (1928) make it appear that the American goosefish, given as *Lophius piscatorius* in "Fishes of the Gulf of Maine" (Bigelow and Welsh, 1925, p. 524), is specifically distinct from the European.

Very small goosefish are seldom reported, hence captures of 1 of 10 inches in February, 1 of 10 inches in April, 2 of 7½ and 10 inches, respectively, in May, 3 of 6¾ to 9 inches in July, and 3 of 4 to 4¼ inches in August between latitudes 43°21′ N. and 37°36′ N. in depths ranging from 35 to 140 fathoms, are of interest.

Sargassum fish, *Histrio histrio* (Linnaeus)

A single specimen about 4¾ inches long, picked up in a purse seine near the surface over the west central part of Georges Bank, by the schooner *Old Glory* on September 15, 1930 (Firth, 1931, p. 14), extends the known range of this fish to the Gulf of Maine.

[14] Parr (1931) has made a revision of the genus *Citharichthys* of the western Atlantic.

Deep-sea angler, *Mancalias uranoscopus* (Murray)

A 24½-inch specimen of this uncommon fish was trawled on Georges Bank February 9, 1927, by the fishing steamer *Ripple;* this is the only record of a member of this family (Ceratiidae) from New England waters (Parr, 1932, p. 12).

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